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What is it Worth? An Economic Evaluation of the MFH Tobacco Initiative

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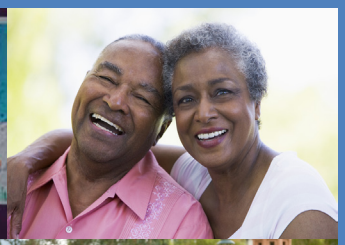

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Executive Summary

In 2004, the Missouri Foundation for Health (MFH) announced the nine-year Tobacco Prevention and Cessation Initiative (TPCI) focused on reducing the health effects and economic toll of tobacco use on Missouri residents. Over the course of seven years, TPCI has funded several strategies ranging from providing direct services to individuals to advancing policy change at the local and state level.

Due to the significant investment MFH has made in TPCI, there was a need for an economic evaluation to assess the Foundation's return on investment. This report presents results from the second economic evaluation conducted by the Center for Public Health Systems Science (*formerly the Center for Tobacco Policy Research*) at Washington University in St. Louis. The economic evaluation will be updated each year throughout the remainder of TPCI.

Methods

Both cost-effectiveness and cost-benefit analysis approaches were used. The costs, benefits, and cost analysis summary measures for all four TPCI strategies included in this analysis were calculated individually and together. Due to the tobacco tax increase not passing, two different scenarios were assessed: 1) the actual election outcome of the tax not passing; and 2) the benefits that would have been gained if the tax had passed. In any economic evaluation a number of assumptions are made; this evaluation took a conservative approach in its assumptions. See the full report for a detailed description of the methods, including all assumptions made.

Evaluation Highlights

The Initiative resulted in savings, despite the failure of the tobacco tax increase.

The total combined benefits for the four TPCI strategies during the time period resulted in real savings: 14,491 quality-adjusted life years (QALYs) gained and lifetime medical care savings of $90.8 million. Therefore, a positive return on investment was seen in the "reality" scenario, despite the tobacco tax not passing.

The success of the tobacco tax strategy would have increased the positive net benefit of TPCI more than seven-fold.

Had the tobacco tax ballot initiative passed, the strategy would have resulted in large benefits both in regard to QALYs and lifetime medical care savings for the people of Missouri. For every $1 spent on TPCI, there would have been medical care savings of $34.37 vs. $4.61, given the reality of the tax ballot measure failing.

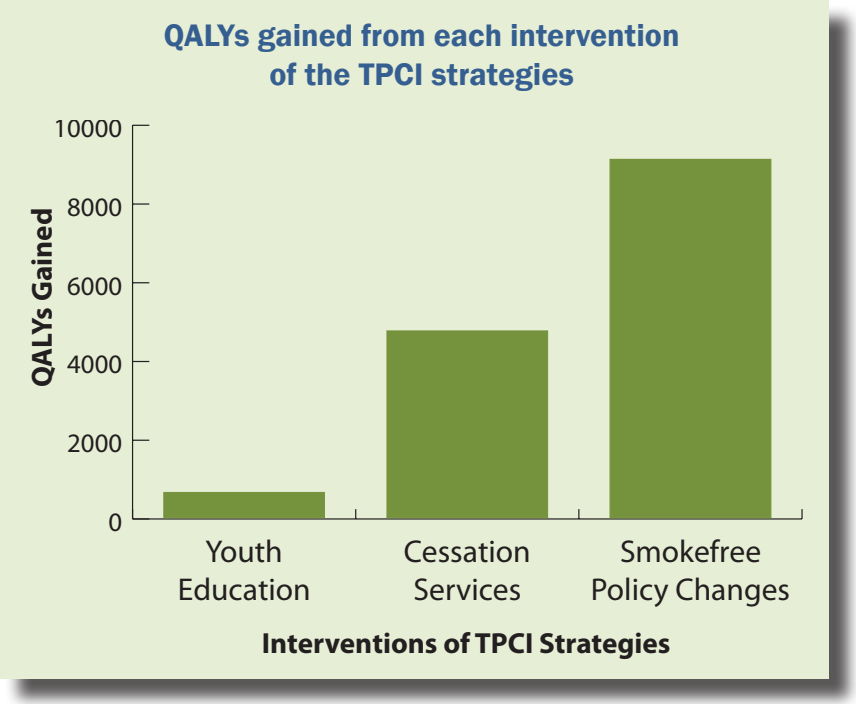
TPCI costs and benefits for the two tax scenarios

	Tax Failed (Reality)	If Tax Passed
Costs	$19,687,754	$19,687,754
QALYs gained*	14,491	114,789
Lifetime medical care savings	$90,773,376	$676,760,265
Cost/QALY gained	$1,358.58	$171.51
Medical care savings/Dollar spent	$4.61	$34.37

*Quality-Adjusted Life Years

Policy changes resulted in the largest benefit.

TPCI grantees implemented a variety of interventions. They advocated for smokefree policy changes (at individual worksites and community-wide), provided cessation services (in-person and via telephone), and implemented educational programs for youth. Across all interventions, smokefree policy changes, particularly on the community level, resulted in two to fourteen times more QALYs gained, in comparison to cessation services and youth education interventions, respectively.



Conclusions

The results of the economic evaluation for TPCI during the specified time period show a net positive benefit across the overall initiative, as well as for the Community Grants, Tobacco Policy Change, and Quitline Enhancement strategies individually. The strategy designed to provide support for tobacco policy change efforts produced by far the largest positive net benefit. The separate economic evaluation for the strategy to raise support for the tax increase showed a net loss of the entire amount of MFH's investment in the educational campaign, as well a total loss of investment by others who funded the political campaign. Had the tobacco tax ballot initiative passed, the strategy would have resulted in large benefits both in regard to QALYs and lifetime medical savings for the people of Missouri. If the effort to increase Missouri's tobacco tax had been successful, the positive benefits for the overall initiative between January 2005 and December 2011 would have increased more than seven-fold.

Based on these findings, we recommend that the public health community advocate for tobacco tax increases and emphasize policy interventions as a main component of a comprehensive tobacco control effort. This analysis also proves useful in understanding the impact of various program components relative to their cost, not just the overall impact and cost of an effort. Analyzing the components of a comprehensive program in this context allows for more effective planning and resource allocation.

It is important to note that other significant components of TPCI, such as capacity-building and recruiting tobacco control advocates for life, were not included because the value of these efforts is not quantified in the literature in terms of QALYs gained and lifetime medical care savings. However, we know that these efforts contribute to a strong tobacco control environment, which in turn leads to QALYs gained and lifetime medical care savings. Additionally, only outcomes for smokers who quit and youth who will not start smoking were included. Other outcomes, such as how the implementation of a smokefree policy results in a decrease in the rate of heart attacks were not included. Finally, other cost savings, such as a decrease in lost productivity from fewer smokers, were not taken into account.

Introduction

Due to the burden of tobacco use in Missouri and limited funding for tobacco prevention and cessation programs, the Missouri Foundation for Health (MFH) identified tobacco use as a major health issue in its service area of 84 counties and the City of St. Louis. In 2004, MFH announced the nine-year Tobacco Prevention and Cessation Initiative (TPCI) focused on reducing the adverse health effects and economic toll of tobacco use on Missouri residents.

Over the course of seven years, TPCI has funded several strategies ranging from providing direct services to individuals to advancing policy change at the local and state level. Table 1 outlines the strategies funded to date by the initiative; programs were implemented in numerous counties across the state.

Table 1. Initiative strategy descriptions and timeframe for inclusion in economic evaluation

Strategy	Description	Timeframe for Assessment
Tobacco Tax	Education campaign focused on increasing support for a tobacco tax increase	Jan 2005-Dec 2006
Community Grants	Funding for grants dedicated to increasing access to cessation services, advocating for smokefree environments, educating students, and promoting youth advocating for policy change	Jan 2007-Dec 2011
Tobacco Policy Change	Funding to support short-term activities conducted to advance policy change at the local level	Dec 2007-Dec 2011
Quitline Enhancement	Support for expansion of Missouri Quitline services	Dec 2007-Nov 2010
Tobacco-related Disparities	Multi-phase program to assess tobacco-related disparities and plan for and implement tailored interventions	Not Assessed
EX Campaign	Funding to support the Legacy Foundation's Become an Ex campaign in Missouri	Not Assessed

In any public health initiative, stakeholders often question whether the investment can be justified by the outcomes. Due to the significant investment MFH has made in TPCI, there was a need for an economic evaluation to assess the Foundation's return on investment. This report presents results from the second economic evaluation conducted by the Center for Public Health Systems Science (*formerly the Center for Tobacco Policy Research*) at Washington University in St. Louis. Although there have been several economic evaluations of individual tobacco cessation and prevention programs, there have been few, if any, to date that have examined a tobacco control initiative with multiple strategies. The economic evaluation will be updated each year during the remainder of TPCI.

Methods

Standard methods for economic evaluations were used.[1] The costs, benefits, and cost analysis summary measures for all four TPCI strategies included in this assessment (see Table 1) were calculated individually and together. The costs and benefits of TPCI were compared to the absence of the initiative. The evaluation was conducted from MFH's perspective as the funder. In any economic evaluation a number of assumptions are made; this evaluation took a conservative approach in its assumptions. A detailed description of the assumptions on costs, benefits, and their valuation in monetary terms is included in the Appendix.

For this evaluation, both cost-effectiveness and cost-benefit analysis approaches were used. A *cost-effectiveness analysis* allows different interventions to be assessed based on what it costs to achieve a particular outcome (*e.g.,* smoking cessation). A strength of cost-effectiveness analysis is that it allows combining cost data with outcome or effectiveness data (*i.e.,* few adjustments have to be made).[1] If a program has a strong and comprehensive evaluation, those data are often available. A challenge with cost-effectiveness analysis is that you can only make comparisons with programs that have the same outcome.

For *cost-benefit analysis*, costs and benefits are assessed in monetary terms. Thus, each intervention can be examined on its own and compared to interventions with different objectives. The difficulty of assigning a value to particular outcomes can make cost-benefit analysis a challenge. We applied both approaches for economic evaluations to allow for examining the costs of a particular outcome, as well as comparisons in monetary terms across and within the TPCI strategies.

Cost-Effectiveness vs. Cost-Benefit Analysis

Cost-Effectiveness Analysis

- Benefits are assessed in terms of outcomes (*e.g.,* youth prevented from smoking)
- Analysis identifies the cost of achieving a specific outcome
- *E.g.,* The program costs $350 per smoker who stays quit

Cost-Benefit Analysis

- All benefits and costs are described in monetary terms
- Analysis determines if the cost is less than the value of the benefit
- *E.g.,* For every dollar spent, $5,000 is saved in medical care costs

Two broad classes of benefits that accrue to society were calculated: quality-adjusted life years (QALYs) gained and lifetime medical care savings per smoker who quit or youth prevented from smoking. The estimated benefits were discounted to a net present value of 3%. This is not to be confused with adjusting for inflation. Discount rates are used to adjust for costs, benefits, etc. distributed across time.[1] Money that is received today is usually considered more valuable than the same amount received in the future, thus future costs or benefits are discounted.

Timeframe

The overall timeframe of TPCI retrospectively examined in this evaluation was January 2005 through December 2011. However, the constituent strategies of TPCI covered varying periods within this timeframe, as illustrated in Table 1.

The efforts to increase the tobacco tax took place during the two-year period from 2005 to 2006. Similarly, funding for enhancement of the Missouri Tobacco Quitline was only provided during December 2007 to November 2010. The first Tobacco Policy Change grant began in December 2007, and funding for the strategy continues today. The Community Grants strategy is also still being funded. The beginning time period for this strategy was selected based on the availability of comprehensive data. These data became available in January 2007, when grantees began reporting on their efforts via an online data collection system.

Calculation of Costs

Only direct program costs were included in the analyses. Costs excluded for all of the strategies were: MFH staff salaries, costs associated with the initiative evaluation, trainings for grantees, and other capacity building activities not related to the direct provision of prevention and cessation services or policy change advocacy.

For the Tobacco Tax strategy, the total funding provided by MFH for the education portion of the tobacco tax initiative was determined. The funding contributed by other organizations for both the education portion as well as the political campaign was also calculated. These costs did not include volunteer hours as those data were not available. The program was heavily dependent on volunteers; unfortunately, records only show the number of volunteers involved and not the amount of time they contributed.

The costs of the Community Grants strategy included the amount of money distributed by MFH to all grantees funded under this strategy. For each grantee, funding was divided by the number of months in the grant award. This allowed the calculation of an estimate of funding for grantees with grants that preceded or continued after the time period being analyzed (January 2007-December 2011). Both volunteer staff time and in-kind donations of people's time were also included in the costs for the Community Grants strategy. To estimate the monetary value of this time, the number of volunteer and in-kind hours reported by grantees in a given year was multiplied by the median hourly wage for all occupations in Missouri for that year.[2] For example, in 2011, community grantees reported a total of 5,046 hours spent on their efforts by volunteers. This number was multiplied by $14.99, the median hourly wage in Missouri during 2011, to estimate a monetary value of the volunteer time. A subset of grantees (14 of 103) were excluded from the analyses because there was no record of their activities for this time period. Additional funding grantees received to implement their programs was also added to the total costs.

Similar to the Community Grants strategy, the Tobacco Policy Change strategy costs included funding provided by MFH to grantees. The funding for each grantee was divided by the number of months in the grant award, in order to estimate the funding for grantees with grants that continued after the time period being analyzed (December 2011). Unlike the Community Grants

strategy, volunteer staff time data, in-kind donations, and additional funding were not available for the Tobacco Policy Change strategy. Because these grantees relied heavily on volunteers, the number of volunteer hours was estimated for each Tobacco Policy Change grant, based on data available from similar grants within the Community Grants strategy. A valuation of the estimated volunteer time was added to the Tobacco Policy Change strategy costs.

Costs for the Quitline Enhancement strategy included the total funding provided by MFH to the Missouri Department of Health and Senior Services (MDHSS) for expansion of the Missouri Quitline. MDHSS also utilized funding from two small federal grants for the Missouri Quitline during the time period of the MFH grant. These exact figures were obtained from MDHSS and added to the costs of the Quitline Enhancement strategy because the benefits of the Quitline were not divided according to funding source. To remove the benefits gained from non-MFH Quitline funding, the percentage of total Quitline funding from MFH (77.1%) was applied to the benefits.

Calculation of Benefits

Data used in the calculation of benefits were provided by grantees. There are other benefits not accounted for that may have resulted from these programs, including capacity-building within the grantee communities. Therefore, in many ways we took the most conservative approach in calculating the benefits of TPCI's programs.

Six types of interventions were implemented across the four TPCI strategies (see Table 2). Two outcomes of these TPCI interventions were estimated: (1) number of adults who quit smoking, for the tobacco tax, smokefree policy changes, and cessation services; (2) number of youth prevented from smoking, for the youth education effort. To keep the analyses standard across all four strategies, two primary benefits that could be calculated were chosen: QALYs gained and lifetime medical care savings. These benefits are common in economic evaluations and can be calculated whether examining adults who quit or youth prevented from smoking.

Table 2. Types of interventions implemented by initiative grantees, by TPCI strategy

Intervention	TPCI Strategy(s)
(1) Education campaign about a tobacco tax increase	Tobacco Tax
(2) Community-wide smokefree policy changes	Community Grants & Tobacco Policy Change
(3) Individual worksite smokefree policy changes	Community Grants
(4) In-person group/individual cessation services	Community Grants
(5) Quitline cessation services	Quitline Enhancement
(6) Tobacco use prevention via youth education	Community Grants

Effectiveness of a Tobacco Tax Increase

Two different scenarios were used to assess the tobacco tax component. The first scenario was the actual election outcome, the failure to pass the tobacco tax increase. In November 2006, Missouri voters rejected the proposed tax increase; 51.4% against, 48.6% in support. The number of adults influenced to quit or youth influenced to not start solely because of the educational campaign were assumed to be minimal and not included in the analysis of benefits. The second scenario was a hypothetical scenario based on the benefits that would have been gained if the tobacco tax increase had passed. Increasing the price of tobacco products is one of the best ways to reduce tobacco use initiation and increase cessation.[3] The strategy of increasing Missouri's tobacco tax will continue to be a recommended practice for the state and thus warranted further examination of the benefits that would have been gained if the tax increase had passed.

To calculate the anticipated benefits if the tax had passed, established price elasticity measures from the literature on tobacco taxes were used.[4,5] Price elasticity measures the responsiveness of a variable (*e.g.*, cigarette sales) to a change in price. For example, for every 10% increase in the price of cigarettes, it is estimated that cigarette consumption is reduced by 3-5%. Since youth and young adults are more responsive to price increases, price elasticities by age group were used, starting with 15-17 year olds.[5] The estimated decrease in smoking prevalence was calculated for each age group. Then, the number of smokers anticipated to quit based on the decrease in prevalence was determined. Data from the Behavioral Risk Factor Surveillance System (BRFSS)[6] conducted during the time period when the tobacco tax increase would have gone into effect were used to calculate the anticipated reduction in prevalence of smoking for each age group in Missouri for every 10% increase in the tax.

Effectiveness of Smokefree Policy Changes

A procedure similar to that described in Ong and Glantz (2005) was used to determine the number of smokers who quit as a result of the passage of a smokefree policy.[7] The procedure accounts for smokers who would quit anyway (21% of quitters), a 90% compliance rate for community-wide policy changes, and a 35% relapse rate. Data provided by grantees on policy changes they were involved in during the time period were used in the calculation. Benefits of community-wide policy changes and individual worksite policy changes were calculated separately, though the numbers used in the calculations were the same, except for the compliance rate, which was only used with community policies. One hundred percent compliance with smokefree policies was assumed for individual workplaces. Benefits from decreasing exposure to secondhand smoke were not included in the calculations and would provide additional benefits.

Effectiveness of Cessation Programs

The number of smokers who quit due to their involvement in TPCI-funded in-person cessation counseling was calculated using 7-day point-prevalence quit rate data at the 6-month follow-up. Grantees collected quit rate data using a standard protocol provided by CPHSS. Based on previous research, a 35% relapse rate was assumed for those who reported having quit at six months.[7,8] An external evaluation of the Missouri Quitline provided tobacco abstinence information, defined as 7-day point-prevalence abstinence at the 6-month follow-up, to estimate the number of smokers who quit because of the Quitline. A 35% relapse rate was also assumed for these quitters.

Effectiveness of Youth Prevention Programs

Three different programs were implemented as part of TPCI's youth prevention efforts. The most conservative approach for estimating the number of youth affected by the programs was used. Two of the three programs primarily focused on training middle and high school youth to educate their peers and conduct advocacy-related activities. For these two programs, only the students directly trained by grantees were counted as affected by the program, and not the peers these students reached. For the third program, the students trained and the youth involved in classroom activities were both counted because a large portion of this program involved lessons and activities conducted in the classroom. Based on a rate of smoking initiation for youth estimated at 10.2% from previous research, the number of youth involved in the programs who would likely become established smokers was calculated.[9] Then based on figures reported in the Institute of Medicine's *Ending the Tobacco Problem: A Blueprint for a Nation*, it was estimated that youth programs would decrease the initiation rate by 10%.[9] From there, the number of youth prevented from smoking due to their involvement in the programs was calculated.

Quality-Adjusted Life Years

Table 3 lists the values used to calculate benefits of the TPCI interventions. Quality-adjusted life years (QALYs) gained were calculated based on the number of adults who quit and the number of youth prevented from smoking. Quality-adjusted life years take into account both the quantity and quality of life gained by an intervention. Two different numbers for calculating QALYs gained were used; one for adults and one for youth. For adults quitting smoking, a value of 1.58 QALYs gained per each sustained quitter was used, based on several past studies.[7,8] This estimate assumes the average quitter is 45 years of age and benefits of quitting cease after the age of 65. For youth, a previously reported estimate of 3.4 QALYs gained per youth who do not smoke was used.[10,11]

Table 3. Values used to calculate benefits of TPCI interventions

Benefit	Value
QALYs generated per quitter*	1.58
QALYs generated per youth not initiating**	3.4
Lifetime medical savings per quitter***	$9,231
Lifetime medical savings per youth who never start smoking***	$19,640

*Keeler et al. (2002) and Ong & Glantz (2005)
**Kaplan et al. (2007) and Holtgrave et al. (2009)
***Hodgson et al. (1992); Adjusted for inflation to 2007 dollars, as an example. Original estimates were adjusted for inflation to each year in the evaluation timeframe and applied separately to the respective number of adults who quit and youth prevented from smoking in each year.

Lifetime Medical Care Savings

Data from Hodgson et al. (1992) on lifetime medical care expenditures due to smoking were used to determine the medical care savings from adults quitting and youth prevented from smoking.[12] These expenditures were reported originally in 1992 dollars and were updated for inflation, according to the medical care component of the consumer price index.[13] The values were converted from 1992 dollars to dollars of each year in the evaluation timeframe (*i.e.*, 2007, 2008,

2009, 2010, 2011) and applied separately to the respective number of adults who quit and youth prevented from smoking in each year. Since Hodgson did not include medical expenditures for former smokers, the medical costs saved by someone quitting were estimated based on work done by the Campaign for Tobacco Free Kids.[14] This work utilized estimates from the Centers for Disease Control and Prevention (CDC) that current smokers have a 50% chance of dying from smoking and former smokers have a 10-37% chance. This suggests that former smokers' excess health care costs compared to those of nonsmokers would range from 10/50 to 37/50 of a smoker's.[14] The medical care costs saved from quitting were based on this assumption. For youth who would be prevented from smoking, excess medical care costs attributed to smokers, compared to nonsmokers, were used. All lifetime medical expenditure savings were discounted at 3% into net present value. For example, in 2007 dollars, the lifetime medical care costs saved per quitter was estimated to be $9,231. The lifetime medical savings for youth who never start smoking was estimated to be $19,640, in 2007 dollars.

Results

The total combined cost for the four TPCI strategies during the time period assessed was $19,687,754. The costs and benefits for each of these strategies are displayed in the following tables: the totals for the actual election outcome of the tobacco tax increase failing (Table 4) and the scenario of the tobacco tax increase passing (Table 5 on the next page). The cost-to-benefit is expressed in two ways: cost of each QALY gained and the amount of lifetime medical care savings per dollar spent. The tables provide these measures for each individual strategy and the initiative as a whole.

In Table 4, the tobacco tax strategy shows that there were no benefits gained from the educational campaign. Despite the tobacco tax increase not passing, the total combined benefits for the four TPCI strategies during the time period resulted in real savings: 14,491 QALYs gained and lifetime medical care savings of $90.8 million. Therefore, the "reality" scenario resulted in a positive return on investment.

Table 4. Total costs and benefits for TPCI strategies, 2005 - 2011

Strategy	Costs	Total QALYs gained	Total lifetime medical care savings	Cost per QALY gained	Medical care savings per dollar spent
Tobacco Tax	$654,000	0	$0	$0	$0
Community Grants	$14,976,741	8,285	$50,947,130	$1,807.64	$3.40
Tobacco Policy Change	$1,057,013	3,707	$24,683,897	$285.15	$23.35
Quitline Enhancement	$3,000,000	2,499	$15,142,349	$1,556.74	$3.89
All Strategies Combined	**$19,687,754**	**14,491**	**$90,773,376**	**$1,358.58**	**$4.61**

In Table 5, the benefits for Community Grants, Tobacco Policy Change, and Quitline Enhancement strategies remain the same as in Table 4; however, benefits gained from the Tobacco Tax strategy are distinctly different. A tobacco tax increase would have resulted in very large benefits for the people of Missouri: 100,298 QALYs and almost $586 million in lifetime medical care savings. Had the tobacco tax ballot measure passed, the positive benefits-to-cost results would have been magnified more than seven-fold; for every $1 spent on TPCI, there would have been medical care savings of $34.37 instead of $4.61, with the tax ballot measure failing. When all of the costs for the tobacco tax campaign are included (*i.e.*, costs of education and political campaigns), the benefit-to-cost ratio would still have been large, $25.43, despite more than $7 million having been spent.

Table 5. Costs and benefits of TPCI strategies, if tobacco tax increase had passed

Strategy	Costs	Total QALYs gained	Total lifetime medical care savings	Cost per QALY gained	Medical care savings per dollar spent
Tobacco Tax	$654,000	100,298	$585,986,889	$6.52	$896.00
Community Grants	$14,976,741	8,285	$50,947,130	$1,807.64	$3.40
Tobacco Policy Change	$1,057,013	3,707	$24,683,897	$285.15	$23.35
Quitline Enhancement	$3,000,000	2,499	$15,142,349	$1,556.74	$3.89
All Strategies Combined	**$19,687,754**	**114,789**	**$676,760,265**	**$171.51**	**$34.37**

A Closer Look at Benefits Associated with Each TPCI Intervention

The activities and potential outcomes for the various TPCI strategies are more complicated than they might first appear. Thus, they warrant closer examination and additional interpretation of the results. As displayed in Table 2, the Community Grants strategy in particular consisted of multiple interventions. For example, adults quitting due to smoking cessation classes does not simply account for the positive outcomes, but also the community smokefree policy changes that have occurred. Additionally, for youth-focused interventions, not only the number of youth who will not initiate smoking account for the benefits, but also the policies youth have advocated for and helped to pass in their schools, individual businesses, and communities.

Table 6 presents additional details regarding the benefits of these individual interventions. The tobacco tax education intervention was excluded because the ballot measure to increase the tobacco tax failed, and therefore produced no benefits. Across all interventions, we estimate that 8,765 adults in Missouri quit smoking due to TPCI-supported efforts. For the youth education programs, we estimate that 189 school-aged children who would have initiated smoking were prevented from doing so.

Smokefree policy changes show the greatest benefits, particularly for community-wide policies. We estimate that 5,369 adults in Missouri quit smoking due to community-wide policy changes,

and an additional 392 adults quit smoking due to worksite policy changes. A greater number of adults were estimated to have quit due to the Quitline cessation services (1,582) than because of in-person group/individual cessation services (1,422). This difference is even more impressive when considering the varying time periods included in this evaluation for the two services; the Quitline was funded for 35 months, whereas 48 months of the in-person services were included in this economic evaluation (see Table 1).

Table 6. Benefits from each intervention of the TPCI strategies, 2007 - 2011

Smokefree Policy Changes	
Community-wide Policy Changes	
Estimated number of adults who quit	5,369
QALYs gained	8,483
Lifetime medical care savings to society	$53,811,962
Worksite Policy Changes	
Estimated number of adults who quit	392
QALYs gained	619
Lifetime medical care savings to society	$3,878,897
Cessation Services	
In-person Group/Individual Services	
Estimated number of adults who quit	1,422
QALYs gained	2,247
Lifetime medical care savings to society	$14,071,163
Quitline Services	
Estimated number of adults who quit	1,582
QALYs gained	2,499
Lifetime medical care savings to society	$15,142,349
Youth Education	
Estimated number of youth who will not start smoking	189
QALYs gained	643
Lifetime medical care savings to society	$3,869,005
Totals	
Estimated number of adults who quit	8,765
Estimated number of youth who will not start smoking	189
QALYs gained	14,491
Lifetime medical care savings to society	$90,773,376

Conclusions

The results of the economic evaluation for TPCI during the specified time period show a net positive benefit across the overall initiative, as well as for the Community Grants, Tobacco Policy Change, and Quitline Enhancement strategies individually. The strategy designed to provide support for tobacco policy change efforts produced by far the largest positive net benefit. The separate economic evaluation for the strategy to raise support for the tobacco tax increase showed a net loss of the entire amount of MFH's investment in the educational campaign, as well as a total loss of investment by others who funded the political campaign. Had the tobacco tax ballot initiative passed, the strategy would have resulted in large benefits both in regard to QALYs and lifetime medical savings for the people of Missouri. If the effort to increase Missouri's tobacco tax had been successful, the positive benefits for the overall initiative between January 2005 and December 2011 would have increased more than seven-fold.

Based on these findings, we recommend that the public health community advocate for tobacco tax increases and emphasize policy interventions as a main component of a comprehensive tobacco control effort. This analysis also proves useful in understanding the impact of various program components relative to their cost, not just the overall impact and cost of an effort. Analyzing the components of a comprehensive program in this context allows for more effective planning and resource allocation.

Limitations

As with all evaluations generally, and economic evaluations specifically, this work has limitations. The limitations include design issues, data concerns, and the many assumptions made in conducting any cost-benefit and cost-effectiveness analysis. The design issues primarily relate to our decisions to use two standard measures to calculate benefits: QALYs and lifetime medical care savings. Establishing standard, common measures applicable across the four strategies was necessary to make comparisons among the four and to combine them to measure a total benefit for TPCI. This is the accepted practice for cost-benefit and cost-effectiveness analyses. This approach likely underestimated the value of the benefit for TPCI since the value of practices such as capacity-building and recruiting tobacco control advocates for life was not included. Additionally, only outcomes for smokers who quit and youth who will not start smoking were included. For example, research shows a decrease in the rate of heart attacks after implementation of a smokefree policy.[15] Finally, other cost savings, such as a decrease in lost productivity from fewer smokers, were not taken into account.

The data concerns primarily relate to the total absence of some important data (*e.g.*, volunteer hours) and the absence of periods of data. These problems result in a less than ideal database when forced to restrict the analyses to several years' worth of TPCI funding and eliminate a small number of grantees from the analysis. Although we would have preferred to have full data, we do not believe that these data problems skew the findings in either direction because neither the cost nor benefits associated with either the excluded years or grantees was included in the analyses.

The final set of limitations concerns the assumptions that must be made when conducting economic evaluations. These assumptions are comprehensively and clearly described in an appendix to this report. All of our assumptions are based on the best information available from published, peer-reviewed literature and recognized, reputable organizations. In all cases, we have made conservative assumptions. Given this approach, if our assumptions have produced biased results, they are much more likely to have underestimated, not overestimated, the benefits of the four strategies and the overall initiative.

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Appendix: Analysis Assumptions

Costs

Across All Strategies

1. Cost of MFH staff salaries, benefits, trainings for grantees, evaluation contracts, etc. not included.
2. Costs for EX Campaign and Tobacco-related Disparities strategies not included.

Tobacco Tax Strategy

1. Number of volunteer hours not included. Data are not available.

Community Grants Strategy

1. Removed funding for grantees for which program data not available (14 of 103 grants).
2. Included volunteer staff time and in-kind donations of people's time. To estimate the monetary value of this time, the number of volunteer and in-kind hours reported by grantees in a given year was multiplied by the median hourly wage for all occupations in Missouri for that year, as detailed in the table below.

	2007	2008	2009	2010	2011
Missouri Median Hourly Wage Estimate[2]	$14.02	$14.52	$14.70	$14.78	$14.99
Total Monetary Value	$67,422.18	$298,589.28	$326,133.02	$181,912.24	$84,930.19

3. Included additional funding grantees received to implement their programs, as detailed in the table below.

	2007	2008	2009	2010	2011
Additional Funding Received by Grantees	$786.00	$11,200.00	$20,552.00	$52,666.63	$24,990.38

Tobacco Policy Change Strategy

1. Exact number of volunteer hours, in-kind donations, and additional funding not included. Data are not available.
2. Because these grantees relied heavily on volunteers, the number of volunteer hours was estimated for each Tobacco Policy Change grant, based on data available from similar grants within the Community Grants strategy. A valuation of the estimated volunteer time was added to the Tobacco Policy Change strategy costs, following the same procedure as described in the Community Grants strategy section.

Quitline Enhancement Strategy

1. Included total funding provided by MFH to the Missouri Department of Health and Senior Services (MDHSS) for expansion of the Missouri Quitline. MDHSS also utilized funding

from two small federal grants for the Missouri Quitline during the time period of the MFH grant. These exact figures were obtained from MDHSS and added to the costs of the Quitline Enhancement strategy, because the benefits of the Quitline were not divided according to funding source. To remove the benefits gained from non-MFH Quitline funding, the percentage of total Quitline funding from MFH (77.1%) was applied to the benefits.

Benefits

Across All Strategies

1. Used the reported 1.58 increase in quality-adjusted life years (QALYs) for each sustained quitter.[7,8] This estimate assumes:
    i. The average quitter is 45 years of age.
    ii. The benefits of quitting cease after age 65.
    iii. A discount rate of 3%.
    iv. A 35% probability of relapse.
    v. A compensation for background quits which would have occurred in the future can be achieved by multiplying the QALYs by a factor of 0.79.
2. Used the reported 3.4 increase in QALYs for each youth who doesn't start smoking,[10,11] discounted at 3%.
3. Used data from Hodgson et al. (1992) on lifetime medical care expenditures due to smoking to determine the medical care savings from adults quitting and youth prevented from smoking.[12] These expenditures were reported originally in 1992 dollars and were therefore first updated for inflation, according to the medical care component of the consumer price index. The values were converted from 1992 dollars to dollars of each year in the evaluation timeframe and applied separately to the respective number of adults who quit and youth prevented from smoking in each year. Since Hodgson did not include medical expenditures for former smokers, the medical costs saved by someone quitting were estimated based on work done by the Campaign for Tobacco Free Kids.[14] This work utilized estimates from the Centers for Disease Control and Prevention (CDC) that current smokers have a 50% chance of dying from smoking and former smokers have a 10-37% chance. This suggests that former smokers' excess health care costs compared to those of nonsmokers would range from 10/50 to 37/50 of a smoker's.[14] The medical care costs saved from quitting were based on this assumption. For youth who would be prevented from smoking, excess medical care costs attributed to smokers compared to nonsmokers was used. All lifetime medical expenditure savings were discounted at 3% into net present value. The table below presents the consumer price index values and medical care savings updated for inflation for each year in the assessment timeframe.

	2007	2008	2009	2010	2011
Consumer Price Index for Medical Care (% change from previous year)[13]	1.044	1.037	1.032	1.034	1.030
Lifetime Medical Care Savings for Smokers Who Quit	$9,231.04	$9,572.59	$9,878.91	$10,214.79	$10,521.24
Lifetime Medical Care Savings for Youth Who Don't Start Smoking	$19,640.51	$20,367.20	$21,018.96	$21,733.60	$22,385.61

Tobacco Tax Increase

1. For the actual outcome of tax increase initiative ("Reality"):
   a. Assumed no benefits given the tobacco tax increase initiative failed.
2. For the "Scenario" analyses:
   a. The age categories for price elasticity (*i.e.,* price effects on smoking) from the literature (Chaloupka, 1999 and Ahmad & Franz, 2008) and the BRFSS Smoking Prevalence Rates for Missouri were not a perfect match; the categories were matched as closely as possible.
   b. Weighted the decrease in prevalence of smoking among the Missouri population age categories by the percentage in those categories; that weighted average was 4.41%.
   c. Divided the price elasticity (*i.e.,* price effects on smoking) for each age group in half because the reported price elasticity is for a decrease in the number of cigarettes consumed; half of the elasticity is the actual reduction in prevalence. For every 10% increase in the tobacco tax, the following percentages were used to calculate the anticipated reduction in prevalence for each age group:

Age	15-17	18-23	24-29	30-39	40-65	65+
Anticipated % decrease in prevalence	4.2%	1.8%	1.5%	1.0%	1.0%	1.6%

Source: Chaloupka, 1999 and Ahmad & Franz, 2008

Smokefree Policy Changes

1. Followed the procedure in Ong & Glantz (2005) to determine number of smokers who would quit if a smokefree worksite policy passed. The procedure accounts for:
   a. Smokers who would quit anyway, without a policy (21% of quitters).
   b. A 90% compliance with the policy change (only for community-wide policies, assumed 100% compliance for individual workplace policies).
   c. A 35% relapse rate for quitters.
2. Did not include benefits from removal of exposure to secondhand smoke (*e.g.,* reduction in heart attacks).

Cessation Programs

1. Calculated number of smokers who quit because of in-person cessation services using TIES quit rate data, specifically the 7-day point-prevalence, intent-to-treat quit rate data at 6-month follow-up. Also assumed 35% probability of relapse and discounted at 3%.
2. Used data from an external evaluation of the Missouri Quitline, specifically 7-day point-prevalence, intent-to-treat abstinence at the 6-month follow-up, to estimate the number of smokers who quit because of the Quitline. Also assumed 35% probability of relapse and discounted at 3%.

Youth Prevention Programs

1. Used the estimated rate of smoking initiation for youth (10.2%)[9] to calculate the number of youth involved in the programs who would likely become established smokers.
2. Used the reported 10% decrease in initiation rate reported in the IOM report , *Ending the Tobacco Problem: A Blueprint for a Nation,*[9] to determine how many youth would not initiate smoking due to programs.
3. Calculated number of youth prevented from smoking due to involvement in the programs.

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